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A Mathematical Model Illustrating Atherosclerotic Plaque Formation

Debasmita Mukherjee[1,*], Lakhsmi Narayan Guin[2], Santabrata Chakravarty[2]

[1]*Department of Statistics, Sunandan Divatia School of Science, SVKM's NMIMS (Deemed to be) University, Mumbai, 400056, India*

[2]*Department of Mathematics, Visva-Bharati, Santiniketan 731235, India*

debasmita.sarada@gmail.com

Atherosclerosis is a chronic inflammatory disease that results from plaque formation in the intima. Atherosclerosis is one of the leading causes of heart disease worldwide. The whole biochemical process of atherosclerotic plaque formation is presented here as an autonomous system of ten nonlinear ordinary differential equations. Concentrations of low density lipoprotein (LDL), free radicals, oxidized LDL, chemoattractants, monocytes, macrophages, T-cells, smooth muscle cells (SMCs), foam cells and collagen are considered as dependent variables in this nonlinear system. The current model has been found to be globally stable. The theory of quasi steady state approximation is used to reduce the ten dimensional model to a three-dimensional system. Numerical analysis of these reduction mechanisms reveals the influence of some important model parameters, which can be advanced to develop a diagnostic strategy to control the dynamics of the disease.